



## THE METAPHYSICAL AND EPIC RISE OF THE SCIENTIFIC METHOD (From the Chaos and Ashes of Superstition and Religious dogmatism) (Scientific Method I)

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**ABSTRACT:** This paper has attempted to sketch the rather shaky beginnings of the metaphysical and epic rise of the "Scientific Method" as it emerges from the midst of superstition and the labyrinths of unbelieving dogmatic authoritarianism of the religious mode into the sunlit skies of logic, coherence and purposeful (systematic) development and power. This rise is traced from its early beginnings in the philosophical musings of the Pre-Socratics, through the intuitive and pragmatic thoughts of Francis Bacon, and the illuminating starting point to the present. @JASEM

The opportune arousal and awakening from a neo-Kantian dogmatic slumber of the worst kind gave the *Scientific method* the necessary impetus and empowerment to become the great and systematic scientific tool that it became in the unraveling of Nature's secrets in certain domains of human knowledge and endeavour. What is more, the range and scope of these domains are further examined, with particular emphasis on the limitations of the Scientific Method itself as it now stands, turning our fairly unrelenting searchlight on its ontological and epistemological underpinnings and presuppositional foundations.

In concluding, a brief assay into the exciting possibilities that await the scientific method as it awakens from a second dogmatic slumber, this time of an *orthodox and conservative "Scientific" mould* that is, 'Scientific' in the narrower sense of the word), to soar like Pegasus into Olympian skies and heights with the freedom and empowerment that comes only from throwing off the limiting shackles and harness of earthbound thoughts to range freely into the limitless realms and vistas of a richer and more all-encompassing consciousness and spirit, to which the human race indeed as a whole properly belongs. Thus, just before plunging into the exciting saga of the Scientific method itself, a brief dwelling on the philosophical grounds for the choice of simplicity and clarity as the medium of expression in this rather all-important exposition, is indeed appropriate at this introductory point.

*On the Need for Simplicity and Clarity of Expression*  
In much of what follows, the philosophical guideline shall be, the golden precepts of *simplicity* and *clarity* of language as the medium of exposition, for such posture is clearly one that augurs well for science as well as for philosophy itself. This is clearly simply in order to avoid certain *abstruseness* and *complexity* of

expression that characterizes much of scientific and philosophical writing that goes by the name of the *modern* and *fashionable*. For it is indeed self evident that *it is only when we are open and clear about what we do not know that we can really begin to take the first truly concrete steps in the direction of true knowledge, and thus, of human progress and Civilization as a whole*. This therefore is the philosophical rationale for keeping the language of this exposition *philosophically simple and clear*, for evidently as Pierce and other great thinkers, both pragmatists and idealist have pointed out, to be fashionable or to speak in a certain accepted or *fashionable* (and stilted) *idiom* is not necessarily to plumb the depths of the unknown; rather, such abstruseness may, wittingly or unwittingly become a *literary device for camouflaging the depths of one's ignorance or philosophical impoverishment, if not a complete lack of knowledge and understanding*. Thus, since, in this philosophical analysis and exposition a commitment is made to exploring the possibilities of a neotic orientation in Science generally as well as in "Scientific Method" in particular, the very beginnings of 21st century science proper, the medium of simplicity and clarity has been chosen as ideal for emphasizing the *seriousness* of the task undertaken, and for revealing or plumbing the depths and ramifications of the known, leading inexorably onwards into the dim outlines of the frontiers and dividing-line between the "known" and the "unknown". Where it appears that a deviation is made from this golden norm, it will be found that *technical usage* and *philosophical idiom* have forced certain *unique modes of expression into the language*, for which an attempt at a simpler rendition would merely lead, in no uncertain or unambiguous way, to a philosophical *blurring of the very outlines* of the exposition that is to be clarified,

and thus to a defeating of the very objectives of this very exposition itself.

A good example of such philosophical usage and idiom forced into play is in the rather brief and critical analysis of that novel aspect of dialectical materialism that is properly referred to as (a) "*historical epistemology*"... (Wartofsky, 1978).

Finally, in pursuance of the ideal of simplicity and clarity, this writer believes that what is true of the development of Western Civilization as a whole is true of the developing areas of the world such as Africa, Asia, Latin America and the Caribbean etc. to mention just a few... Thus these *noetic orientations* will be traced historically and philosophically and thus globally from their ancient Greek origins and particularized only in those ontological and epistemological domains where the Nigerian and African culture and experience lends a special coloring to and thus a particular philosophical exemplification of *the generalized philosophical theme*.

*Subsumption of the Terms, Scientific, Technological and Mathematical... (i.e. Science in General)*

In pursuance of the ideal of clarity of presentation, it is important to note, in passing that the word "Science" may be used in *three* major ways - first, to denote the many sciences such as Physics, Chemistry, Biology, Astronomy, Geology and Psychology. This usage also includes *Mathematics* and *Logic*, which are sometimes referred to as formal or abstract Sciences, and disciplines like Meteorology, Botany and Mineralogy, which are often, called descriptive or *empirical* sciences as well as the emergent "Sciences" of Politics, Economics and Sociology, which are essentially social in Orientation.

Secondly, the term "Science" may be used to denote a body of systematic knowledge, including the hypotheses, theories and laws that have been built up by the work of numerous scientists through the years. This body of knowledge is thus primarily theoretical, in contradistinction to the practical or pragmatic skills and the arts, and has been appropriately defined by Conant (1951) as:

*'An interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observations'*

Thus, it may properly be said that there is no "Science in general", except in so far as the term is used collectively to denote the various natural sciences or the body of facts that have been accumulated within their precincts.

Thirdly, and finally, for a large number of philosophers, educators and scholars alike, the term "Science" is used to designate *a method of obtaining*

*knowledge that is both objective and verifiable*, thus satisfying Popper's famous criterion of "*testability*" (Popper, 1972). In this sense, the term is essentially synonymous with what we now refer to as the "Scientific Method".

Thus all the various aspects of the term "Science", that is, the *knowledge*, the *motives* and *products*, and the very process or method itself are well summarized in a survey by Bajah et al, which defines "Sciences" as:

*The systematic study of nature, as knowledge obtained by observations and the testing of facts... (Bajah and Okebukola, 1984).*

For the purposes of this exposition therefore, all the definitions given above are naturally implicitly connoted, while bearing in mind the distinctive property of science which links all these various definitions together and which is the very heart of the system - none other than the very *process* or *method* itself known as "the Scientific Method". It is in this light that Albert Einstein's characterization of Science is rather apt and philosophically all-embracing as a Scientific viewpoint. For him, Science is an attempt to *make the chaotic*

*Diversity of our sense experience correspond to "a logically uniform" system of thought (Einstein, 1940)*

Thus, armed with this truly all-embracing definition, the assumption is made that wherever the term "*science*" occurs hereafter in this exposition, it connotes all the scientific, philosophical and mathematical definitions, (including the technological spin-offs and by-products of science proper) and exemplified by that aspect of the system that is implicitly common to all the various definitions, "*the Scientific Method*", *the very heart of the system* itself, as a whole.

*The Early Beginnings: (The Birth of Philosophy and thus of Science and Western Civilization itself).*

In order to properly understand what is meant by *Scientific* progress, the very beginnings of Science, as it were is traced, following its often *tortuous* course historically and philosophically to the present day level of developments which are referred to as the Scientific and Technological heritage of Western Civilization as a whole. The Philosophical task will be an attempt to unravel in as far as this is possible, the *heart* of the system itself, that is, the very mechanisms responsible for progress and development in general..., and to subject the findings to such critical philosophical analysis as would make for the sustaining (if not increasing) the *momentum* of development, the *dynamics* of progress, as it were, both in the immediate present and also in the years to

come. In other words, an attempt is made to find out, towards the end of this exposition, what Scientists, philosophers and scholars alike must do in order to review, maintain or sustain the momentum of scientific progress, for the future development of human Civilization and the survival of man as a whole..., lest this civilization in its turn also suffer, by the inescapable judgement of posterity, from "the bane of Byzantinism"...!, as postulated in another paper (Chinwah, 2001)

#### *The Same Epic Journey*

Thus, just before plunging into this rather engrossing tale of Scientific adventures and discoveries, it is important to stress the overall philosophical posture and strategy: that, in order to understanding the state of Science and Technology today, how man was able to arrive at these great heights, *the same epic journey over the territory traversed and mastered by these great minds is made*, the orientation being primarily historical and philosophical in order to bring to light the very heart of the system, the mechanism, as it were, responsible for the very development of Science and Technology, and the advancement of culture and civilization as a whole.

#### *From the Early Greek Thinkers to Rene Descartes and "The Cogito"*

The epic journey is traced as far back as the 5th and 6th Centuries B.C., to that:

*"incomparable golden age in which the human spirit flowered in an abundance greater than men have since known". (Nietzsche, 1971).*

In this historic period of human civilization, those early Greek thinkers became curious about the nature of the world and of ultimate reality itself, seeking to reduce all that was visible to a single simple constituent or "substance" known as "*the substratum*". These early thinkers thus initiated a new way of philosophical thinking and eventually of scientific investigations that led, by various paths, to the grand architectonic which today is known as Western Civilization, a complex matrix of philosophical and scientific knowledge and achievements that ranks among the highest achievements of Man's creative genius in any epoch, and anywhere in the world.

#### *The Drive Towards A "Consistent Logical Development"*

Thus from the early beginnings (c. 500 BC) when the great Greek philosophers like Thales of Miletus, Socrates himself, Plato and Aristotle had laid the firm metaphysical and philosophical foundations for the development of Western Science and thus of Western Civilization as a whole, progress towards a proper grasping and understanding of the physical, visible

world was rather slow, being hampered largely by superstition, religious dogma and a general lack of method or consistent logical development. After the fundamental work of the early Greek thinkers, it took the bold mind, centuries later of the early "Scientific thinkers" like Roger Bacon (1214 - 1294), the English Franciscan, and Francis Bacon (1561-1626), the most articulate protagonist of "*the Scientific Method*", in its early form, to impel man in the right direction, towards a systematic and consistently logical method of investigation, which has developed into the full-blown system that we know today as "*the Scientific Method*".

Much later on, and closer to our times, the French philosopher, Rene Descartes (1596-1650), building on the impetus of the Renaissance towards free inquiry, unhampered by the dogmas of the church and the superstitions of the peoples, the way was prepared, as it were, for the rapid development of Scientific experimentation in the seventeenth Century. Rene Descartes, considered the father of modern Science as such, had successfully sought the indubitable and apodictic starting point of all knowledge in his "*cogito*" and his method of systematic doubt. Thus, as Stuart Hampshire pointed out in the philosophical classic, *the Age of Reason*, clear thought and rational argument were increasingly identified with the cartesian method of analyzing complex ideas into their simple components and of deducing consequences from the most simple, self-evident propositions in the manner of Pure mathematics... (Hampshire, 1956). It is indeed for this reason that Descartes is generally (and properly so too) taken as the first great modern philosopher, as well as the father or founder of modern Scientific method, as earlier mentioned, Thus not only did Descartes invent a style of abstract argument that was clear and simple, and thus largely free from the technicalities of scholastic Latin, but also did his all-pervading influence make philosophy and Science a proper part of French literature and culture, and the French Language itself was to become the focus of European Civilization for this very reason, followed ultimately by the English Language...

#### *The Uneasy Marriage Between Science (Natural Philosophy) and Religion*

It is important to remember at this point that, until the passing away of the great English Scientist and Philosopher, Sir. Isaac Newton, and even later, there was indeed no generally recognized or clear line of distinction or demarcation between philosophy and the Natural Sciences., Thus, the term "*Natural Philosophy*" was the common term embracing metaphysics and what today we know properly as the Science of Physics. Thus, it is pertinent to note, in

passing, that Descartes and Leibniz were *not only philosophers* in our narrow, modern-day definition of the word, but were also distinguished scholars in the history of *mathematics* as well as of *Science*. *Indeed, it was part of the function of metaphysical philosophy in those days to suggest the forms of explanation and system of concepts, which Scientific investigators of nature were in general, to use.* Thus it is indeed clear that particularly in the works of Descartes and Leibniz, the problems of what we would now call "theoretical physics" were *intermingled and intertwined* as it were, with the usual perennial problems of philosophy...

#### *The Rapid Rise of Modern Science*

Thus with the emergence of a *coherent and acceptable starting point* and a *simple and systematic method of logical development*, Scientific discoveries and technological achievements of *historic proportions* soon became the order of the day. With the publication of John Locke's famous *Essay Concerning Human Understanding*, English thought in general, and specifically *English empiricism* rapidly spread across the channel and thus formed the *basis of radical thought* throughout Europe in the eighteenth century. *Thus the seventeenth century can properly be called "the Age of Reason"*, for virtually all the philosophers of the period were trying to introduce the rigor of *mathematical demonstration or methodology* into *all possible areas of knowledge*, including philosophy itself! We therefore find that the form of philosophical argument in Descartes, Spinoza and Leibniz is largely *"deductive a priori"*, their intention being to *prove* their conclusions about *the ultimate constituents of reality* and the *limits of human knowledge* in much the same way as a mathematical theorem is proved. It is now common knowledge that Hume and Kant argued strongly against *such deductive metaphysics*, which they considered empty and without content. Thus, the philosophical and Scientific *dialogue* continued on both sides of the Atlantic Ocean, involving the French, British, German, Italian and American Scholars, Scientists and Philosophers *until that vast and imposing edifice called Western Civilization, that "grand architectonic", the complex matrix of philosophical, Scientific and Technological knowledge and achievements, was erected.* Thus, one needs only consider in passing, in passing, how the views of the nature of man and the world, (not to talk of the *quality* of our lives), our whole ontological, epistemological and cultural orientations have changed as a result of the application and use of a *coherent and logical Scientific methodology* by such brilliant minds as Copernicus, Galileo, Kepler..., Darwin, Newton, Freud, Planck, de-Broglie and Einstein (to mention just a few of the pioneering

geniuses), in the *unravelling of the mysteries of the Universe* which for *thousands of years* before this period had remained a *closed book* to man. Such indeed is the *awesome power of science*; the *Scientific Method* had finally come into its own, and, as this exposition tries to point out, this is to be considered *only just* the beginning, *the very tip of the iceberg, as it were of what is possible and indeed achievable!*

#### *Conclusion: The Vienna Circle and the Logic of Logical Positivism Revisited*

With the vast and historic achievements of Science in the relatively short period of time stretching from Descartes to the twentieth century, a new interest in the history and philosophy of science developed, which was to lead to *unexpected results* such as a richer *understanding and appreciation of the very process* by which modern science itself had *come into being*. It is now common knowledge that the pioneers who *initiated* interest in this type of philosophical analysis of the history and development of Science was a group of Philosophers and Scientists who gathered in Vienna between world Wars I and II, and developed a philosophical School of thought known as *"logical positivism"*. Thus since the views of these philosophers and scientists were *central*, even though *in an oblique manner*, to the philosophical conclusions towards which this exposition is tending, it is indeed important to focus the attention on the *salient and crucial* features of the *logical positivist Weltanschauung or view of Science and Scientific explanation*, in order to properly prepare the ground on which the concluding philosophical and Scientific orientations are ultimately built. Thus, as Hempel and Oppenheimer make clear to us (Hempel, Carl G et al, 1984), *the central idea of the positivists was always to show, as it were, a deductive connection between the statement of the general law and of certain initial conditions on the one hand, and the statement of the event to be explained or predicted on the other.* Thus, according to the logical positivist theory of Science, the reason for the *universal characteristic of science*, as opposed to virtually every other human endeavour, lies in the *logical structure of Scientific explanation and theorizing!* Thus, starting from a *universally available data-base*, made up of *factual observation reports*, acquired by direct observation of nature, with or without instruments, *scientists develop inductions or generalizations* which we call *laws*, a body of which together go to make up *the theories of science*. Thus, it is important to note that the databased or observation reports are *logically prior* to the logical inductions, that is, to the laws and theories, which Scientists erect with the data base serving as building blocks. Thus, the *absolutely crucial facts* about the

reports, which make up the database, are that *they are public, objective, unbiased and verifiable factual reports*. Further, more important than the non-ideological, non-political, and non-religious character of the Scientific data, as it were, is the *ABSOLUTE NEUTRALITY* of such data with regard to the laws and theories which scientists build on them! It therefore follows from this characteristic of the data, which we call *theory-neutrality* that two Scientists with opposed theories have a common ground for debate, namely, the database that they share with all other Scientists. Thus, as the logical positivists affirmed, the International scientific community will be able to choose between two opposing theories on so-call purely objective, scientific grounds, to which naively posed position of "rigorous objectivity" the existentialist philosopher Karl Jaspers would indeed, as it were posit his now celebrated and rather polemical retort, that:

*The sclerosis of objectivity is (indeed) the annihilation of existence... (Jaspers, Karl ....)* which sobering thought indeed places the whole matter, in an excitingly philosophical and contemplative mood, as the further development of Scientific Method into the New Millennium and beyond is awaited, as we shall see in the subsequent paper, titled, "The Epic Saga of the Scientific Method" which follows after this (Scientific Method II) (Chinwah, 2001).

## REFERENCES

- Chinwah, U.H. (1988) Phenomenological and translucent box theories... *Journal of Pedagogy*, Port Harcourt, Nigeria.
- Chinwah, U.H. (2001): The Epic Saga of the Scientific Method (Scientific Method II), In press.
- Conant, James Bryant (1951) *Science and Common Sense* (New Haven Yale University Press), New Haven
- Godel, K. (1931) *Uber Formal Unentscheidbare Satze der Principles Mathematica Und Verwandter Systeme. Monatshefte fur Mathematik und Physik*; (Reprinted in Davis, 1965).
- Hampshire, Stuart, (1956), *The Age of Reason* (New American Library), Boston.
- Harman, Willis (1989) "Spirituality, Science and the transformation of consciousness", *World Goodwill*, Vol. 3.
- Heisenberg, Werner (1871) *Physics and Beyond; Encounters and Conversations*, Harper and Row, New York.
- Hempel and Oppenheimer (1964) *The Logic of Explanation* D. Van Nostrand Co., New York
- Holton, Gerald, (1969) "Einstein and the Crucial Experiment" *American Journal of Physics*, Vol. 37 68-92.
- Holton (1969) "Einstein, Michelson, and the Crucial Experiment" *Isis*, Vol. 60 (1969), 133-197
- Holton (1968) "Mach, Einstein and the Search for Reality" *Daedalus*,
- Holton (1968) "On the origins of the Special Theory of Relativity" *American Journal of Physics*, Vol. 31 (1968), 37-47.
- Husserl. (1934) *Phanomeonologischen Untersuchungen (Phenomeonological Investigations)*, Vienna, Austria.
- Kuhn, T.S. (1957) *The Copernican Revolution*, Harvard University Press (Cambridge, Massachusetts)
- Kuhn, T.S. (1962) *The Structure of Scientific Revolutions*, McGraw-Hill Co., New York.
- Wartofsky, Marx W. (1978) *Picturing Modeling and Representing: Science and Art as Modes of Cognitive Praxis* (i.e. Towards an Historical Epistemology) Lecture Notes from work in Progress, Boston University, Boston, 1978.